

GLENDALE ROAD BRIDGE

Crossing Deep Creek Lake on Glendale Road

McHenry Vicinity

Garrett County

Maryland

HAER No. MD-88

HAER
MD
12-MHENV,
1-

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD

National Park Service

Northeast Region

U.S. Custom House

200 Chestnut Street

Philadelphia, PA 19106

HISTORIC AMERICAN ENGINEERING RECORD

GLENDALE ROAD BRIDGE

HAER NO. MD-88

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Location: Crossing Deep Creek Lake on Glendale Road, McHenry vicinity,
Garrett County, Maryland
UTM: 17.645200.4374060
Quad: McHenry, Maryland

Date of Construction: 1924

Engineer: Charles B. Hawley & Company

Fabricator: McClintic-Marshall Construction Company (trusses)

Present Owner: Garrett County
Roads and Bridges Department
Oakland, Maryland

Present Use: Vehicular bridge

Significance: Glendale Road Bridge is a two-span, steel Pennsylvania (Petit) truss bridge, with sub-struts, constructed in connection with the development of Deep Creek Lake by the Youghiogheny Hydroelectric Corporation in Garrett County, Maryland. Fabricated in 1924 by the McClintic-Marshall Construction Company under contract to the hydropower company and in cooperation with local government officials, the bridge carries Glendale Road over Deep Creek Lake in Garrett County, Maryland. The Glendale Bridge was determined eligible for listing in the National Register of Historic Places by the Maryland Historical Trust on November 8, 1991.

Project Information: This documentation was undertaken from August 1992 through October 1992 by Garrett County as a mitigation measure prior to removal of the bridge.

P.A.C. Spero & Company
Historic Structures Consultants
Baltimore, Maryland
for Garrett County

GLENDALD ROAD BRIDGE
HAER NO. MD-88 (Page 2)

Located near Thayerville in Garrett County, Maryland, the Glendale Road Bridge carries Glendale Road over Deep Creek Lake. The bridge has spanned the lake at "The Narrows" since 1924, when it was fabricated and built by the McClintic-Marshall Construction Company of Pittsburgh and the Charles B. Hawley Construction Company of Washington, D.C., under contract to the Youghiogheny Hydroelectric Corporation and in agreement with the Garrett County Commissioners.

Glendale Road Bridge is a double-span, Pennsylvania (Petit) steel truss bridge 500 feet in length. The bridge consists of two Pennsylvania (Petit) truss spans (with sub-struts and auxiliary horizontal struts), each span being 250 feet long, supported by a reinforced concrete center pier and two abutments of reinforced concrete. The trusses are spaced 17 feet on centers. All truss connections in the Pennsylvania (Petit) trusses are riveted connections. Unlike other trusses erected in the late nineteenth and early twentieth centuries, the individual truss members appear more solid, and consist primarily of H-sections, channels and angles. The verticals, diagonals, and lower chords are simple steel H-sections, while the upper chords are built-up members comprising two channels with lacing bars and upper cover plates. The bridge has a clear roadway width of 14 feet, 7-inches and carries a single lane of vehicular traffic. The original white oak plank floor was replaced as early as 1953 by a steel mesh deck. The floor beams are steel H-sections.

Beneath the center of the bridge, Deep Creek Lake is approximately 40 feet deep. The single solid shaft of the center pier rises approximately 66 feet above its foundation on solid rock. The east abutment rises some 41 feet above its foundation, in order to accommodate the earth fill required for the roadway approach on the east. Founded on a natural rock outcropping, the west abutment rises from 3 to 6 feet above exposed rock; wingwalls rising approximately 5 feet 6-inches above the abutment seat flank the western roadway approach.

Historical research indicates that the Glendale Road Bridge was constructed by the Youghiogheny Hydroelectric Corporation and its agents during development of Deep Creek Dam and Lake, a massive construction effort of the 1920s which permanently transformed the economy and physical geography of central Garrett County.

First settled by European colonists during the mid-eighteenth century, Garrett County was officially established as a new county through partition of Allegany County in 1872. The westernmost county in Maryland, Garrett County is also the most mountainous and least densely-populated of Maryland counties. The North Branch of the Potomac River constitutes the county's winding southern boundary, while the northern portion of the county entirely borders Pennsylvania. Tributary to the Ohio, the

Youghiogheny River and several feeder streams (Casselman River, Bear Creek, and Deep Creek) also enter the county. Although criss-crossed by the high elevations of the western ridge of the Allegheny Range, the county is marked by so-called "glades" or grassy pastures. Legacies of the retreat of Ice Age glaciers, these distinctive wetlands once characterized the stream valleys of the county, including the valley of Deep Creek prior to development of Deep Creek Lake.

Historically, Garrett County's economy has featured a diverse mix of agriculture, mining, lumbering, and resort recreation. The predominant economic activity throughout the nineteenth and early twentieth centuries was farming; in 1910, oats cultivation, corn growing, and stock raising were still extensively practiced. Between 1850 and 1920, agricultural profits were generally spurred by introduction of mechanized farm equipment and scientific farming techniques. Numerous farms in the northern portion of Garrett County, in the vicinity of Grantsville, New Germany, and Accident, were first settled by "Plain Sect" families of Mennonite and Amish faith.

The heavy extractive industries of coal mining and lumbering flourished during the post-Civil War era, when adequate technology and the pushing of the Baltimore and Ohio Railroad westward up the North Branch of the Potomac promised good returns to entrepreneurs such as railroad president, John Work Garrett, and lumber baron, Henry Gassaway Davis. As mines were sunk and forests cut, tramroads and narrow-gauge tracks brought coal and timber to processing and marketing centers along the rivers and railroads. Garrett, Davis and their associates also promoted the recreation industry of Garrett County, founding a posh resort hotel at Deer Park in 1872. The Deer Park resort, which attracted a wealthy clientele in its heyday, closed in 1924. Also founded under B & O Railroad auspices, the well-appointed Oakland Hotel operated across the tracks from the Oakland Railroad Station between 1875 and 1907. A longer-lived summer community of a decidedly different kind was Mountain Lake Park (1881-1941), established by Methodist ministers as Maryland's "Mountain Chautauqua." For sixty years, Mountain Lake Park offered a wide variety of topical and religious lectures for improvement of the mind, and a forty-acre artificial lake for improvement of the body.

Construction of the Baltimore and Ohio Railroad (B & O) into Garrett County offered transportation facilities for the industrial "company towns" as well as the railroad resort hotels and Mountain Lake Park. Of equal importance, however, was the growth of a reliable road system within the county. Although state and Federal authorities took an interest in vehicular transportation in the upland plateau region from an early date, road construction and maintenance posed a continual problem for Garrett County residents during the nineteenth and early twentieth centuries. Constructed and maintained under Federal auspices from 1811 to 1833, the pioneering Cumberland

Road or National Road (precursor to today's Old U.S. Route 40) ran westward from Baltimore and Cumberland to Wheeling, passing through the northeast Garrett County town of Grantsville, where inns catered to travellers. A key factor in the prosperity of Grantsville and environs, the National Road nevertheless required large expenditures and constant maintenance to avoid becoming nearly impassable.

The 1899 Maryland Geological Survey Report on the Highways of Maryland described the status of Garrett County's road network during the peak period of extractive industrialization. Characterized by steep grades, narrow width, and dirt roadbeds filled with rocks and potholes, the county's 650 miles of road were generally "the roughest in the state." Some roads were originally cut through as lumber roads and "were scarcely more than clearings," and many roads "on a sidehill location" were too narrow for teams to pass. The twenty-two mile long section of the National Road was the only stone-surfaced road in the county, but "in many places" was "worn down to the large foundation stones." With no tolls collected since 1878 and traffic on the wane, the National Road was "in bad condition" despite an annual county appropriation of \$600 for its repair.

Although many industrial companies employed scientific techniques to tap and transport the rich mineral and timber resources of Garrett County, local government there on the eve of the twentieth century did not yet include a professional roads department. Road repair remained "under the immediate control of 167 supervisors," each of whom managed five road workers drawn from the surrounding vicinity. Approximately one week per year was spent on roadwork by the supervisors and their crews. The Maryland Geological Survey regretfully noted that "the steep grades on most of the county roads which resulted from inattention to their proper locations when the roads were first laid out can only be remedied by relocation." Soil composition (primarily clay with sand) allowed "very good dry-weather roads" to be made, but "with much travel they become deep with dust in dry weather or with mud in wet weather."

Between 1889 and 1898, Garrett County levied a total of \$113,414 for road work, of which \$90,745 was spent on road repairs, \$16,199 for bridges, and \$6,508 on new road construction. Although early road and bridge records for both Garrett and Allegany Counties are incomplete, available maps indicate that, by 1900, precursors to many of today's roads, including Glendale Road, roads between the Deep Creek area and Grantsville, and State Route 219 between Oakland and the National Road, were substantially in place. Transforming economic patterns, construction of the Deep Creek Hydroelectric Dam and Powerhouse by the Youghiogheny Hydroelectric Corporation during the 1920s resulted in realignment of Glendale Road and many other central Garrett County routes. Alert to the fact that numerous important roads would be partially or fully inundated by the proposed lake behind the dam, the county

commissioners worked closely with the power company to secure transportation improvements such as the Glendale Road Bridge at little or no cost to local citizens.

Prior to the 1924-1925 creation of Deep Creek Lake, life and labor in the Glendale Road vicinity centered on lumbering, farming, commerce at the nearby communities of Thayerville and Oakland, and some recreational activity along Deep Creek. The white pine tracts of the area first attracted logging companies immediately after the Civil War, when proximity of the woodlands to the B & O Railroad promised ready shipment of timber. In 1868, Henry Gassaway Davis established a lumber yard at Deer Park (east of Oakland), then built a tramroad west from the yard into the Deep Creek valley. Several miles southwest of present-day Route 219, the tramroad divided, with one branch heading directly into the Thayerville-Glendale Road vicinity while the other branch proceeded west to a point near the mouth of Deep Creek on the Youghiogheny River. Davis then erected a sawmill at the site of the present Deep Creek Dam and Powerhouse; cut lumber from the mill was sent by mule-drawn cars down the tramroad to Deer Park, then shipped via the Baltimore & Ohio Railroad. Davis's original branch tramroad into the Glendale Road area was also used and extended by the firm of Stemple & Casteel, who sent lumber to Deer Park from their sawmill on Meadow Mountain Run.

Active between 1868 and 1892, the Davis logging operation was the largest in the Deep Creek region but not the last to employ rail transport in the surrounding woods. A final logging railroad was eventually built by George D. Browning, a lumber entrepreneur who also saw service as a state senator. Initially utilizing portions of the Davis tramroad and grade, Browning between 1915 and 1922 operated a narrow-gauge railroad to take finished lumber from his various portable steam sawmills in the Deep Creek valley to a B. & O. spur at Oakland. Browning's "private railroad" was taken over by the Youghiogheny Hydroelectric Corporation in 1922, and used to haul building materials to the Deep Creek Dam and Powerhouse construction site. In 1925, the railroad was permanently inundated by the rising waters of Deep Creek Lake.

George Browning also fostered the early development of recreation along Deep Creek in the era prior to Deep Creek Lake and the building of the present Glendale Road Bridge. Like his ancestor, the pioneer and hunter Meschach Browning (whose Forty-Four Years of the Life of a Hunter remains a classic of its genre), "Senator" Browning lived part of each year in the upper Deep Creek valley, constructing in 1892-1893 "a large and attractive residence for summer visitors and sportsmen" at the base of Meadow Mountain on the eastern side of the creek. Browning at the same time built a timber dam a short distance upstream from the present site of Glendale Road Bridge. This dam impounded "Lake Brown", a body of water about a mile long and from two hundred to three hundred yards wide with a channel some ten to fifteen feet

GLENDALE ROAD BRIDGE
HAER NO. MD-88 (Page 6)

deep. Browning stocked Lake Brown with fifty-thousand trout brought from Druid Hill Park in Baltimore; canoeing and fishing were popular pastimes at the lake, according to local residents and an 1893 article in the Montgomery County Sentinel.

By 1898, Browning's dam at Lake Brown was recorded on United States Geological Survey maps as a "state dam," indicating that since 1893 it had become part of a Maryland state fish hatchery complex including the lake. Road docket information is incomplete, but available maps and the 1893 Montgomery County Sentinel article indicate that the road from Thayerville to the state dam was the direct precursor to the present Glendale Road, and that George Browning built an early (possibly the earliest) bridge over Deep Creek along this road. Sentinel correspondent "W.K." noted in the October 20, 1893 article that "a short distance from the house, not more than 100 yards, Senator Browning has constructed of white oak, and at considerable cost, a bridge across the lake two hundred and seventy-five feet long reminding us much of the heavy structures along the Metropolitan road above Rockville." "W.K."s reference to the latter structures alluded to the large timber trestles built during the 1870s along the Metropolitan Branch of the Baltimore and Ohio Railroad between Washington and Point of Rocks.

The 1898 USGS topographical map depicted the county road running almost due east from the main road at Thayerville (now Route 219), to cross Deep Creek on Browning's bridge, located virtually at the site of his dam. That Browning's bridge and the precursor to Glendale Road were somewhat south of the present Glendale Road Bridge is confirmed by the 1898 map and by "W.K.", who wrote of standing on the bridge looking north to the so-called "cat rocks" or rocky outcroppings where the current bridge was later built. In September 1986, the Garrett County Historical Society published in The Glades Star a photograph of Browning's bridge supplied by local resident Richard L. Maroney. Though indistinct, the photograph shows a lengthy approach protected by railings and leading to a bridge, which appears to have inclined end posts. Describing the bridge as a "steel and timber structure," the Glades Star editors noted that "the roads which led to this bridge are still in existence" and were "used for access to cottages in the area that are built on the shoreline of Deep Creek Lake."

The realignment of Glendale Road and the construction of the present Glendale Road Bridge were directly due to the creation of Deep Creek Lake by the Youghiogheny Hydroelectric Corporation, a firm which successfully tapped the great hydropower potential of Deep Creek above its junction with the Youghiogheny. Chartered in 1908 by the State of Maryland, the power company intended to develop electricity to be sold to the rapidly growing southwest Pennsylvania market centered around Pittsburgh and Johnstown. In 1912, a charter amendment allowed the firm to

GLENDALE ROAD BRIDGE
HAER NO. MD-88 (Page 7)

build bridges (as well as dams, gates, sluices, tunnels, stations, and other buildings) and utilize county roads "under such reasonable regulations and conditions" as local officials prescribed. A second amending law of 1912 specified "transportation" as a right, privilege, or asset which the company could hold or dispose of on lands it intended to purchase for the project. In 1914, the state legislature authorized the firm to own and maintain a so-called "Safety Strip", a twenty-five foot wide strip of land to extend around the entire proposed lake to assure high-water control.

Between 1914 and 1921, the Youghiogheny Hydroelectric Corporation conducted further field studies to determine appropriate hydropower sites in the Youghiogheny watershed. Initial plans proposed three dams on the main river and one at the Deep Creek site, but by the summer of 1921 planning centered only on the latter, where an 86-foot high dam would funnel water to a long tunnel and powerhouse to develop an operating head of 440 feet. On July 19, 1922, the Public Service Commission granted final approval to the power company's charter, with the proviso that the firm "shall begin construction and prosecute it to a really substantial extent" within four years. Additional authorization was secured in 1924 to erect power lines on and over the public roads of the state and the county.

The Youghiogheny Hydroelectric Corporation promptly fulfilled the terms of the Public Service Commission order of 1922. The subsidiary Eastern Land Corporation began to acquire all land and property that would be "flowed" or isolated by the projected lake, and a second subsidiary, the General Construction Company, let a contract for all necessary design and construction to Charles B. Hawley & Company, consulting and constructing engineers of Washington, D.C. Almost 7000 acres comprising 140 farms were bought, of which about 4500 acres were actually flooded. Nearly 15 miles of roadway required relocation, including four miles of the improved state road (now Route 219) between Oakland and the National Road (U.S. 40). An August 23, 1924 agreement with Garrett County allowed the power company to close part or all of nine county roads; a special quarry and stone-crusher provided crushed stone for the new sections of road. Construction work on the dam began early in the winter of 1923, with a workforce of about 1000 men. The dam and brick powerhouse were completed in March 1925, and the twelve-mile long reservoir proceeded to fill. On May 26, 1925, with Deep Creek Lake fully formed, the hydroelectric plant began operations.

Worried about access to Oakland and nearby markets, residents in the Glendale (Upper Deep Creek valley) area first persuaded the county to require the Youghiogheny Hydroelectric Corporation to macadamize Sand Flat Road, a major route linking Deer Park and the Thayerville region. Records also indicate that the hydropower company unsuccessfully petitioned to close a part of Glendale Road (by 1924, the county road

leading east from Thayerville to the state dam and Browning's bridge was so designated). On August 28, 1924, in a front-page article entitled "Hydro-Electric Power Company to Build Roads," the Oakland Republican reported that the county commissioners had recommended "that application No. 9, to close a portion of the Glendale Road at "The Narrows", be rejected, and in lieu thereof the said applicant shall be allowed to change the course and grade of said road... and to erect across Deep Creek at "The Narrows" a steel bridge, 14 feet in width, at its cost."

Thus, Garrett County authorized construction of the present Glendale Road Bridge under power company supervision and at the company's expense. The required "road notice" published first on August 21, 1924 in the Oakland Republican by the firm provided a comparison of the old and new alignments of Glendale Road. The firm altered the road "by closing all that portion of said road beginning at a point about 400 feet Northeast of the present bridge at the Narrows, and extending in a Westerly direction about 2500 feet Westward of said bridge, and to open in lieu thereof a road extending in a northwesterly direction about 1000 feet from the first point of closing mentioned, thence across Deep Creek in a southwesterly direction about 3000 feet across the lands of the Eastern Land Corporation and R.S. Browning to a point on the Glendale road about 1700 feet Eastward of the State Road to Oakland."

County commissioners offered several additional guidelines and specifications concerning the bridge. It was to have two 250-foot "Truss Spans", with a "Center Concrete Pier & Concrete Abutments." The floor was to consist of four-inch thick white oak planks with a "2-inch Additional wearing surface." The "floor load" was to be "50 lbs. per Square foot" while the "Moving load Capacity" would be "two 15-ton trucks passing." The power company would provide "Necessary fills and approaches" and the new bridge and road would be accepted by the county as a public highway only when the new route would be made ready "as good as the present road leading to present bridge."

Garrett County also directed that, "excepting as above defined," the bridge should be built in accordance with the "Final Report on Specifications for Design and Construction of Steel Highway Bridge Superstructure", published by the Special Committee on Specifications for Bridge Design and Construction of the American Society of Civil Engineers. This report, issued on February 4, 1924 by a blue-ribbon panel of bridge engineers including Henry B. Seaman, John E. Greiner, and Milo S. Ketchum, was a significant early twentieth century effort to standardize the construction of fixed span highway bridges of all sizes. For spans 150 feet or more in length, the Committee recommended usage of riveted or pin-connected trusses, with a general preference given to "trusses with single intersecting web members, or other forms of trusses possessing the least ambiguity in computed stresses and the greatest elements

of serviceability." Members should "be symmetrical about the central planes of the trusses" and "all parts shall be designed so that they can be inspected, cleaned, and painted."

For through riveted or pin-connected spans, the Committee favored inclined end posts. The width between centers of trusses should be "sufficient to give lateral stiffness and prevent overturning by the specified lateral forces" and in no case should be "less than one-twentieth of the span." The report recommended that the depth of trusses "shall be not less than one-tenth of the span" and endorsed a minimum clear width of roadway of 12 feet for one line of traffic. Bridges designed for two lanes of highway traffic "shall preferably have a clear width of roadway of not less than 20 ft." Regarding lateral forces, the Committee's recommendations were explicit: "Spans of 150 ft. and less shall be designed to resist a lateral force of 300 lb. per lin. ft. on the loaded chord and 150 lb. per lin. ft. on the unloaded chord; for spans of more than 150 ft., for each additional 30 ft. of span there shall be added 10 lb. per lin. ft. for the loaded chord and 5 lb. per lin. ft. for the unloaded chord."

Garrett County's requirement that the power company follow the American Society of Civil Engineers highway bridge specifications reflected the growing professionalism of rural county road and bridge administration during the early automotive era. Similarly, the Youghiogheny Hydroelectric Corporation's choice of Charles B. Hawley & Company and the McClintic-Marshall Construction Company as, respectively, the designer and fabricator of the Glendale Road Bridge, signified the hiring of two contractors who could be counted on to produce a professionally engineered structure for the site. Born in Painesville, Ohio, in 1886, Charles Burrige Hawley was a graduate of the Case School of Applied Science in Cleveland. He saw service as an engineer with the Aluminum Corporation of America (later ALCOA), then moved to Washington, D.C. in 1920, setting up a practice as "consulting engineer" and president of Charles B. Hawley & Company. He retained these positions during his company's rise to prominence as a designer and builder of dams, hydroelectric plants, and attendant facilities throughout the United States and in Europe. Hawley was also active in professional societies, serving as President of the Washington Society of Engineers in 1928 and as the society's representative to the American Engineering Council in 1929. Charles B. Hawley & Company was dissolved after Hawley's death on July 26, 1952.

Selected to fabricate the steel trusses of the Glendale Road Bridge, the McClintic-Marshall Construction Company was the world's largest independent steel fabricating firm during the 1920s. The Pittsburgh-based company was founded in 1900 by Howard Hale McClintic and Charles Donnell Marshall, fellow Lehigh University graduates and senior engineers at the Shiffler Bridge Company. When the Shiffler works were taken

over by the American Bridge Company, McClintic and Marshall approached financiers Andrew and Richard Mellon, who advanced them \$150,000 to start a company on condition that they operate the Pottstown, Pennsylvania plant of the Philadelphia Bridge Works, which the Mellons had just bought. Improved and enlarged, this plant became the first McClintic-Marshall facility. Later acquisitions or interests included the Koppers Company of Delaware, with its patents for manufacture of coke and by-products; the Riter-Conley Company of Leetsdale, Pennsylvania, makers of blast furnaces, gas holders, transmission towers, oil storage tanks, steel barges, and plate work of all kinds; and the Steel Frame House Company.

McClintic-Marshall established its main plant at Rankin, Pennsylvania; by 1930, the company also operated four other plants in Pennsylvania, two factories in California, two plants in Chicago and one in Buffalo, New York. With general offices in Pittsburgh, thirteen branch offices were maintained throughout the nation (two in Ohio) and a "Foreign Contract Department" was located in New York City. In 1931, the firm became a subsidiary of Bethlehem Steel Corporation. During the 31 years of its independent existence, McClintic-Marshall submitted approximately \$550 million in total invoices. By 1931, the company had paid over \$8 million in dividends and was valued at \$64 million. McClintic and Marshall retired after the sale to Bethlehem Steel, but remained active in professional engineering circles until their deaths in 1938 and 1945, respectively.

McClintic-Marshall's leadership in the field of steel bridge fabrication rested upon a record of outstanding achievements. Prior to erection of the Glendale Road Bridge, the firm provided structural steel for the Beaver Bridge over the Ohio (1908-1909), Gustav Lindenthal's Sciotoville Bridge over the Scioto River (1915-1916), and the A.H. Smith Memorial Bridge over the Hudson at Castleton, New York (1923-1924). Subsequent to 1924, McClintic-Marshall fabricated "high steel" for many large structures, including the Carlton Bridge over the Kennebec in Maine (1927), the Ambassador Bridge between the United States and Canada near Detroit (1927-1929), the Outerbridge Crossing near Perth Amboy, New Jersey (1927-1928), the George Washington Bridge over the Hudson (1927-1931), the High Bridge over Harlem River in New York City (1928), the Mt. Hope Bridge in Rhode Island (1928-1929), the Cooper River Bridge at Charleston, South Carolina (1928-1929), the Maumee River High-Level Bridge at Toledo, Ohio (1930-1931), and the Illinois River Bridge at Chillicothe (1930-1931).

In 1934, the firm began work making structural steel for the Golden Gate Bridge between San Francisco and Oakland, California. Other bridges supplied by McClintic-Marshall included the Armour-Swift-Burlington Bridge over the Missouri River at Kansas City and the Bear Mountain Bridge over the Hudson. Additionally, the company undertook work outside the sphere of bridge construction. In 1913, McClintic-Marshall

GLENDALE ROAD BRIDGE
HAER NO. MD-88 (Page 11)

fabricated the huge steel lock gates for Gatun Locks in the Panama Canal. Manhattan buildings whose construction the firm aided included Grand Central Terminal, the Waldorf-Astoria Hotel, the RCA Building, the Salmon Tower, the New York Central Railroad Building, and the Graybar Building. In Chicago, the company provided steel for the original Marshall Field Building, the Merchandise Mart, and the Civic Opera House.

In Pittsburgh, McClintic-Marshall supplied structural components of the dome at the Cathedral of Learning of the University of Pittsburgh. The company set a construction record when it put into place 16,000 tons of steel in three months for a new plant of the Baldwin Locomotive Works at Eddystone, Pennsylvania. Another large industrial project the firm completed was the erection of the Tata Iron and Steel Company works at Jamshedpur, India.

In 1924 McClintic-Marshall fabricated the members for the Glendale Road Bridge. Original drawings indicate that the Rankin Plant was responsible; all details are delineated on the drawings.

The decision to make the Glendale Road Bridge a two span, through truss bridge with riveted connections officially stemmed from Garrett County's requirement that the power company follow the American Society of Civil Engineers specifications for steel highway spans 150 feet or more in length. The choice of bridge type, however, was also made in the context of the long, successful history of the usage of metal truss vehicular bridges in the United States. In his 1908 handbook The Design of Highway Bridges and the Calculation of Stresses in Bridge Trusses, the well-known consulting engineer and civil engineering professor Milo S. Ketchum offered a succinct definition of the truss:

A truss is a framework composed of individual members so fastened together that loads applied at the joints produce only direct tension or compression. The triangle is the only geometric figure in which the form is changed only by changing the lengths of the sides. In its simplest form every truss is a triangle or a combination of triangles. The members of the truss are either fastened together with pins, pin-connected, or with plates and rivets, riveted.

The basic components of a simple metal truss bridge include top and bottom chords, web members characterized as verticals or diagonals and connected to the chords at joints, the portals, stringers, floor beams, and deck. The top and bottom chords are the structural members which carry the major loads exerted on the bridge. The particular arrangement of the chords and the web members determines the specific truss type. The portal is the space of a truss which forms the entrance to the bridge,

while stringers consist of the longitudinal members, placed parallel to the direction of traffic, which transmit the highway deck loads to the floorbeams. These are set transverse to the direction of traffic in order to convey the deck loads to the bridge trusses. The deck provides direct structural support for the loads caused by vehicular traffic. The truss generally rests on piers or abutments at points designated as bearing seats.

Initially constructed in wood, truss bridges were first built of cast iron during the 1840s along the route of the Erie Canal. Early builders gradually made the shift from wood to iron, with many transitional structures featuring iron rods solely for tension members and wood for the remainder of the truss. In 1847, the renowned bridge builder Squire Whipple noted that cast iron, which fractures on impact and cannot carry tensile loads, was desirable for use in compression members, while wrought iron, being ductile and not brittle, was best suited for tensile members. By 1850, with rolled wrought iron shapes becoming more widely available, more bridges were being built solely of metal. After the Civil War, large bridge companies proliferated, and between 1880 and 1895, a second transition was made from wrought iron to structural steel.

A wide variety of truss types was eventually developed by the early twentieth century. The two predominant types were the Warren and Pratt trusses. The Warren truss was pioneered in the early nineteenth century but was popular well into the twentieth century. Usually built with riveted connections, the Warren truss was a combination of isosceles or equilateral triangles. In the Warren type, the diagonals carry both compressive and tensile forces. Ketchum's 1908 Design of Highway Bridges illustrated a quadrangular Warren through truss bridge with parallel top and bottom chords, but depicted or recommended no Warren truss variation featuring a polygonal, inclined, or curved top chord. Nonetheless, Warren trusses in many varieties remained popular for use in spans from 50 to 400 feet in length. Like the Pratt types, the Warren trusses could be fabricated at a shop to specifications provided by a client, then shipped to the site and erected with the aid of markings on the metal members. During the late nineteenth and early twentieth centuries, many bridge companies published catalogs of their available structures, with order forms and detailed instructions to determine which bridge type was suitable for a given site.

Many trusses were variations of the Pratt truss, patented by Thomas and Caleb Pratt in 1844. The Pratt truss has its vertical web members in compression while its diagonal web members resist the tensile force. Generally pin-connected rather than riveted, Pratt trusses were built from the mid-nineteenth century through the early twentieth century. Bridge engineer and historian J.A.L. Waddell observed in 1916 that the Pratt truss was the most commonly used truss type for spans under 250 feet in length. By 1910, Pratt through trusses (where the deck is located near the bottom

GLENDALE ROAD BRIDGE
HAER NO. MD-88 (Page 13)

chord) were available in various forms, including the Parker truss (having a polygonal top chord), the Camelback truss (a Parker truss with polygonal top chord of exactly five slopes), and the Pennsylvania (Petit) truss (a Pratt or Parker featuring subdivision of the panels by an auxiliary framework of sub-struts or sub-ties).

Bridge historian Waddell noted in 1916 that "nearly all trusses of ordinary span lengths are being designed of the Pratt or Petit type." Surviving plans indicate that the Glendale Road Bridge was designed as a two span, Pennsylvania (Petit) truss with an auxiliary framework of horizontal sub-struts. All connections designed for the bridge were riveted. Prior to about 1910, such spans were generally pin-connected because riveting could only be accomplished in the fabricating shop. Pin-connected trusses then offered the advantages of easy manufacture, shipment, and construction. In the early twentieth century, however, portable equipment was developed which permitted riveting to be done on site. No records of truss erection at the Glendale Road Bridge were found, but it is likely that McClintic-Marshall fabricated the truss members, then transported them to Deep Creek where they were riveted together by laborers under the direction of Charles B. Hawley & Company. McClintic-Marshall manufactured longer metal truss spans with polygonal top chords during the same period, including the 1923-1924 A.H. Smith Memorial Bridge over the Hudson (two spans, 400 and 600 feet) and the 1930-1931 Illinois River Bridge at Chillicothe (440 foot main span).

Construction of the Glendale Road Bridge proceeded in late 1924 under supervision of Charles B. Hawley & Company with laborers employed directly by the power company's construction subsidiary, the General Construction Company. A newspaper description of a fatal accident at the bridge site reveals some details about construction of the pier and abutments. The Oakland Republican reported on November 13, 1924, that laborer John Schlossnagle had been killed at "The Narrows Bridge" in the following manner:

The man...was on top of the center pier, 70 feet above the creek bed, when a signal was given that a blast to remove rock from an excavation nearby was about to be fired. Schlossnagle protected himself by creeping beneath a sluiceway used to convey concrete to the pier from a mixer on the bank of the creek. A rock weighing perhaps fifteen pounds was thrown skyward when the explosion took place and in descending struck the bottom of the sluice just above the man's head. The impact was so great that the concussion crushed Schlossnagle's skull.

Extant bridge plans and drawings provide further information about the fabrication and erection of the bridge. The Charles B. Hawley Construction Company was concerned to find a solid foundation for the east abutment, noting "if not good

rock, excavate to satisfactory rock and notify Washington Office of elevation of same." The truss members were manufactured at the Rankin, Pennsylvania, works (the main plant) of McClintic-Marshall, with J.B. Baxter in charge of shop operations. The major necessary components included top and bottom chords, end posts, hangers (verticals), diagonals, subdiagonals, struts, top chord braces, sway braces, floorbeams, and stringers. Floor planks consisted of "4" by 12" oak planks, laid heart side down, with not exceeding 1/4" joints between planks, and securely nailed to nailing strips with 1" wire spikes." Joints in floor planking were to be "adzed smooth after being laid." The metal trusses were to be given a coat of red lead paint, with an anti-running agent of "yellow ochre or lamp black."

Although the bridge plate (no longer extant) indicated that Glendale Road Bridge was completed in 1924, a search of all 1924-1925 county commissioners' minutes and Oakland Republican issues revealed no references to the finished bridge or its opening. Maintenance records are incomplete, but indicate that the bridge's original plank flooring was replaced by a steel mesh deck as early as 1953. In 1961, the Glendale Road Bridge was painted and cleaned, and beginning in 1967 was the subject of planning and engineering studies to better accommodate the tremendous increase of automotive traffic in the area. The bridge has evidently changed little since its original construction.

As part of the Deep Creek Lake project, at least two other bridges were constructed prior to the 1925 beginning of operations at the Youghiogheny Hydroelectric Company's dam and powerhouse. The Deep Creek Bridge, a double-span riveted through truss bridge similar to the Glendale Road Bridge, carried U.S. Route 219 over Deep Creek Lake between Thayerville and McHenry from its construction by the Bethlehem Steel Corporation in 1924 to its removal and replacement in 1987. Also associated with the hydropower and lake development was the State Park Road Bridge, a single span Pratt through truss, which carried State Park Road across the lake from the mid-1920s until its removal by Garrett County in 1984.

From its 1924-1925 completion to the present day, the Glendale Road Bridge has been one of the most important engineered structures in Garrett County. Serving as the only east-west crossing of Deep Creek Lake and located on a key county road that has linked Oakland and vicinity with the Grantsville region for a century, the bridge from the start directly aided and encouraged the growth of the Deep Creek Lake recreation industry. As early as 1927, the Baltimore Sun published Garrett County profiles urging Maryland motorists and tour bus riders to visit the lake. A 1932 article touted the area's hunting, fishing, boating, and winter sports, noting that snow fences and rotary plows generally kept all roads open for tourist use. With few boat landings yet established, sailing "between the two bridges" (Glendale Road Bridge and the U.S. 219 Deep Creek Bridge) was a popular pastime of the late 1920s and early 1930s. Prior

to 1930, Holy Cross Camp and Camp Gary were established in the Glendale Road Bridge vicinity. In 1937, at the end of an access road at Turkey Neck Inlet south of the bridge, Cy Bowers founded the Deep Creek Yacht Club, which celebrated its fifty-fifth anniversary in 1992.

During the New Deal era, Civilian Conservation Corps (CCC) workers added to the recreational attractions of Garrett County through construction of lakes, cabins, camp sites, bridle paths, and hiking and skiing trails in Herrington Manor State Forest near the mouth of Deep Creek. The CCC also undertook projects in the Potomac and Savage River State Forests. A Sun news story of May 23, 1937 noted that the sixty-seven mile shoreline of Deep Creek Lake already boasted "about 1,000 permanent summer residents, with a usual population of 5,000 on Sunday afternoons, attracted by the swimming, sailboat racing, and fishing." Every year since 1925, state conservation rangers had added thousands of trout, pike, perch and bass to Deep Creek Lake. On August 9, 1941, the Sun recorded that "prospects of a large scale real estate development along Deep Creek Lake loomed" when a group of four developers announced their plan to purchase six tracts and eight miles of shoreline "north of Glendale bridge."

The heyday of recreation at the lake, however, occurred after World War II, when the availability of affordable autos, better inter-county and interstate roads, and more leisure time and disposable income allowed greater numbers of vacationers from Baltimore, Washington, and Pittsburgh to visit the region. In 1947, the Deep Creek Lake Association's promotional map depicted Glendale Road as hard-surfaced and the Glendale Road Bridge as a major link in the route from Oakland to Grantsville. Two camps were shown located on the northern side of the road just west of the bridge, and numerous "swimming and boat" sites were in the vicinity. By 1947, about one-third of the shoreline of the lake was developed, with 547 lots sold. About 300 cottages had been built since 1925; the first area commercial ski slope opened in 1947 on Hooppole Ridge above the Sand Flat Road. On September 16, 1951, the New York Times took notice of Deep Creek Lake as a "highland retreat" and offered detailed instructions concerning roads New Yorkers might take to reach the lake in a two-day drive. Times writers Doris and Harold Faber were impressed that the Deep Creek Lake promotion council maintained a permanent information booth along U.S. 219 near McHenry.

A 1953 article observed that "new and improved roads have brought many changes to Garrett County," a fact amply documented by the 1953 edition of the USGS topographical map covering the area, which depicted new camps and recreational forests in the vicinity of the Glendale Road Bridge. Successor to the Youghiogheny Hydroelectric Corporation, the Pennsylvania Electric Corporation (PENELEC) worked

GLENDALE ROAD BRIDGE
HAER NO. MD-88 (Page 16)

with state and local officials to monitor and plan recreational development of Deep Creek Lake and environs. Although plans for hotel and motel strips along the lines of those at ocean resorts were discouraged, by 1958 some \$2 million was spent annually by vacationers in Garrett County. A major new draw was Deep Creek Lake State Park, located at the end of State Park Road about a mile beyond the east side of Glendale Road Bridge. This public park, with a swimming beach and boat landing along a mile of shore frontage, opened on July 1, 1959 and has operated continuously since then. In 1962, over 188,000 vacationists visited the park, which like all other Garrett County attractions, was periodically promoted in the Baltimore Sun.

By 1967, a tourist booklet noted that "1,530 privately-owned vacation homes" were located at Deep Creek Lake, while the State Park recorded 130,000 visitors in 1965. In 1967, the Baltimore-based consulting engineers Rummel, Klepper & Kahl concisely summarized the instrumental role played by the Glendale Road Bridge during more than forty years of recreational growth at Deep Creek Lake:

This crossing occurs midway the length of the lake at a point where the opposing shorelines converge to within a distance of approximately five hundred feet; a most convenient location for the crossing of a lake of this size. With connections to U.S. Route 219 west of the lake, and to Maryland Route 495 to the east, Glendale Road serves as a main access to the areas around the lake, and provides the most direct passage between its western and eastern shores. This road also links the lake region with the various surrounding State Parks and Forests to provide a well-coordinated system of recreational areas.

In the quarter century since 1967, as many subsequent planning studies, newspaper articles and promotional guides have demonstrated, the key economic role of the Glendale Road Bridge has not varied, even though the bridge itself may not now meet current traffic conditions. Increasing traffic loads and volumes, coupled with extreme roadway curves at both approaches, make this one-lane bridge a hazardous crossing. Garrett County is proposing the demolition of the two-span truss bridge and the construction of a two-lane replacement bridge.

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HAER NO. MD-88 (Page 19)

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HAER NO. MD-88 (Page 21)

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